

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/551,854 Confirmation No. 6166
Applicant (s) : Zenon Lysenko, et al.
Filed : September 30, 2005
TC/A.U. : 1621
Examiner : Cutliff, Yate Kai Rene
Title : ALDEHYDE AND ALCOHOL COMPOSITIONS DERIVED FROM
SEED OILS

Docket No. : 63104A
Customer No. : 00109

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

CORRECTED COPY OF RESPONSE C, FILED APRIL 30, 2008

Responsive to the Official Action dated January 31, 2008, in the above-identified patent application, please enter into the record the following amendments and documents filed concurrently herewith: Supplementary Information Disclosure Statement, Form PTO SB/08a, Revised Declaration I Under Rule §1.132, and Declaration II Under Rule §1.132. Please reconsider the application in view of the aforementioned information and the following remarks.

Amendment to the Specification begins on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Amendments to the Drawings - None

Remarks/Arguments begin on page 8 of this paper.

Amendment to the Specification

In the paragraph at page 18, lines 19-32, continuing onto page 19, lines 1-4, please make the following amendment.

The alcohol composition disclosed herein may be oligomerized in the presence of a catalytic initiator to form oligomeric polyol compositions that find utility in the preparation of polyurethane slab stock flexible foam applications. Representative process conditions for the alcohol oligomerization and description of the polyols derived therefrom may be found in US Provisional Patent Application Serial No. 60/465,685 (Attorney's Docket No. 62260), entitled "IMPROVED PROCESS TO MAKE VEGETABLE OIL BASED POLYOLS AND POLYOLS MADE THEREFROM," filed April 25, 2003, in the names of Zenon Lysenko et al.; and in related US Non-provisional Patent Application [[Serial No. _____]] Serial No. 10/553,767 (Attorney's Docket No. 62260A), also entitled "IMPROVED PROCESS TO MAKE VEGETABLE OIL BASED POLYOLS AND POLYOLS MADE THEREFROM," filed concurrently herewith, in the names of Zenon Lysenko et al., which non-provisional application claims the priority benefit of said Provisional Patent Application Serial No. 60/465,685; said provisional and non-provisional patent applications being incorporated herein by reference. The oligomeric polyol compositions thus prepared generally possess an average molecular weight in the range from about 600 to about 6,000. Polyurethanes prepared with these oligomeric polyols possess acceptable properties, including acceptable cross-link density, for use in slab stock flexible foams. Details of the manufacture of such foams and description of their properties may also be found in the aforementioned co-pending US patent application.

Amendment to the Claims

Listing of Claims

This listing of claims replaces all previous listings of claims in this application.

1. (Cancelled)

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Cancelled)

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Cancelled)

11. (Cancelled)

12. (Cancelled)

13. (Cancelled)

14. (Cancelled)

15. (Cancelled)

16. (Cancelled)

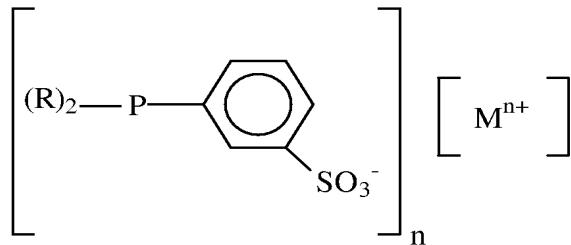
17. (Cancelled)

18. (Previously presented) An alcohol composition comprising a mixture of hydroxymethyl-substituted fatty acids or fatty acid esters comprising in terms of hydroxy distribution from greater than about 10 to less than about 95 percent mono alcohol, from greater than about 1 to less than about 65 percent diol, and from greater than about 0.1 to less than about 10 percent triol by weight, based on the total weight of the composition, and further having a diol to triol weight ratio of greater than 5/1.
19. (Original) The alcohol composition of Claim 18 further comprising from greater than about 3 to less than about 35 percent saturates.
20. (Original) The alcohol composition of Claim 18 or 19 further comprising from greater than about 0 to less than about 10 percent unsaturates.
21. (Previously presented) The alcohol composition of Claim 18 having a diol to triol weight ratio of greater than about 8/1.
22. (Original) The alcohol composition of Claim 18 comprising less than about 10 weight percent total impurities selected from the group consisting of lactols, lactones, saturated cyclic ethers, unsaturated cyclic ethers, and heavies.
23. (Original) The alcohol composition of Claim 18 comprising from greater than about 25 to less than about 70 percent monoalcohol, from greater than about 20 to less than about 50 percent diol, and from greater than about 0.5 to less than about 5 percent triol substituted fatty acids or fatty acid esters, by weight.
24. (Previously presented) The alcohol composition of Claim 18 comprising from greater than about 30 to less than about 45 percent monoalcohol, from greater than about 25 to less than about 45 percent diol, and from greater than about 1 to less than about 4 percent triol substituted fatty acids or fatty acid esters, by weight.
25. (Previously presented) The alcohol composition of Claim 18 being prepared by a process comprising (a) contacting a mixture comprising unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally, free organophosphine metal salt ligand, under conditions sufficient to hydroformylate

greater than about 80 and less than about 99 weight percent of the unsaturated fatty acids or fatty acid esters to monoformyl products, based upon the conversion of one unsaturated bond per molecule of unsaturated fatty acid or fatty acid ester, so as to obtain a hydroformylation reaction mixture comprising an aldehyde composition of formyl-substituted fatty acids or fatty acid esters; (b) separating the aldehyde composition from the hydroformylation reaction mixture; and thereafter (c) hydrogenating the aldehyde composition with a source of hydrogen in the presence of a hydrogenation catalyst under process conditions sufficient to obtain the alcohol composition.

26. (Previously presented) A process of preparing an alcohol composition comprising (a) contacting a mixture comprising unsaturated fatty acids or fatty acid esters with carbon monoxide and hydrogen in the presence of a Group VIII transition metal-organophosphine metal salt ligand complex catalyst, and optionally, free organophosphine metal salt ligand, under conditions sufficient to hydroformylate greater than about 80 and less than 99 weight percent of unsaturated fatty acids or fatty acid esters to monoformyl products, based upon the conversion of one unsaturated bond per molecule of unsaturated fatty acid or fatty acid ester, so as to obtain a hydroformylation reaction mixture comprising an aldehyde product of formyl-substituted fatty acids or fatty acid esters; (b) separating the aldehyde product from the hydroformylation reaction mixture; and thereafter (c) hydrogenating the aldehyde product with a source of hydrogen in the presence of a hydrogenation catalyst under process conditions sufficient to obtain the alcohol composition comprising a mixture of hydroxymethyl-substituted fatty acids or fatty acid esters comprising in terms of hydroxy distribution from greater than about 10 to less than about 95 percent mono alcohol, from greater than about 1 to less than about 65 percent diol, and from greater than about 0.1 to less than about 10 percent triol by weight, based on the total weight of the composition, and further having a diol to triol weight ratio of greater than 5/1.

27. (Original) The process of Claim 26 wherein the ligand is a monosulfonated tertiary organophosphine represented by the following formula:



wherein each R group individually represents a radical containing from 1 to about 30 carbon atoms; wherein M represents a metal cation selected from the group consisting of alkali and alkaline earth metals; and wherein n has a value of 1 or 2 corresponding to the valence of the particular metal cation M.

28. (Original) The process of Claim 27 wherein the ligand is selected from the group consisting of the monosulfonated salts of triphenylphosphine, diphenylcyclohexylphosphine, phenyldicyclohexylphosphine, tricyclohexylphosphine, diphenylisopropylphosphine, phenyldiisopropylphosphine, diphenyl-t-butylphosphine, phenyldi-t-butylphosphine, and mixtures thereof.

29. (Original) The process of Claim 26 wherein the Group VIII transition metal is selected from rhodium, ruthenium, cobalt, iridium, and mixtures thereof.

30. (Original) The process of Claim 26 wherein the hydroformylation is conducted at a temperature of greater than about 45°C and less than about 200°C and a total pressure greater than about 1 psia (6.9 kPa) and less than about 10,000 psia (69 MPa).

31. (Original) The process of Claim 26 wherein the aldehyde composition is separated from the hydroformylation reaction mixture by extraction.

32. (Original) The process of Claim 26 wherein the hydrogenation catalyst comprises a metal selected from the group consisting of Group VIII, Group I, and Group II metals and mixtures thereof.

33. (Original) The process of Claim 32 wherein the hydrogenation catalyst

comprises Raney nickel or supported nickel.

34. (Original) The process of Claim 26 wherein the hydrogenation is conducted at a temperature greater than about 50°C and less than about 250°C and at a pressure greater than about 50 psig (345 kPa) and less than about 1,000 psia (6,895 kPa).

Claim 35. (New) The composition of Claim 18 wherein the ester of the hydroxymethyl-substituted fatty acid esters is derived from a C₁₋₁₅ alkanol.

REMARKS

A. Concerning the Amendment to the Claims

New Claim 35 is added limiting the hydroxymethyl-substituted fatty acid esters to those esters derived from a C₁₋₁₅ alkanol. Support for the new claim is found at page 10, lines 18-24, of the specification.

It is estimated that, after amendment, a total of 18 claims and 2 independent claims are pending in the application. Accordingly, it is estimated that no fee is required for entry of new dependent Claim 35. If this estimate is incorrect, the Examiner is authorized to charge Deposit Account 04-1512 the required fee for entry of the new claim.

B. Concerning the Amendment to the Specification

The Office Action raises an objection concerning the specification at page 18, line 26, for having a blank space after "Serial No." and before "(Attorney's ...)". An amendment is made hereinabove to the specification deleting the blank space and inserting "Serial No. 10/553,767" identifying the cited US application. In view of the amendment, it is respectfully requested that the objection be withdrawn.

C. Concerning a Supplementary Information Disclosure Statement

The Examiner's attention is directed to a Supplementary Information Disclosure Statement and Form PTO SB/08/a, filed concurrently herewith, citing two documents including International Patent Application PCT/US07/86222, filed December 3, 2007, entitled "ALDEHYDE AND ALCOHOL COMPOSITIONS DERIVED FROM SEED OILS," (Attorney's Docket No. 65324A), and naming as inventors Wei-Jun Peng, David A. Babb, Aaron Sanders, Christopher Derstine, Jorge Jimenez, Zenon Lysenko, Kurt Olson, Joe Phillips, Brian Roesch, and Alan Schrock, some of whose names overlap with named inventors of the instant application. The international application is assigned to Dow Global Technologies Inc, the same assignee (of unrecorded assignment) of the instant application. The international application is currently unpublished; however, a copy is provided herewith.

The relevance of the aforementioned international patent application is discussed in Section E of this paper and in "Declaration II Under Rule §1.132," submitted concurrently herewith.

D. Concerning Submission of Revised Declaration I Under 37 C.F.R. §1.132

Applicants submitted on November 26, 2007, a Declaration under Rule 132. The Declaration inadvertently omitted stating when and how certain reaction components were added to a formulation to effect reaction with polyols to form polyurethanes, although the components were named in a list of reactants at page 6 of said Declaration. In order to ensure that no misunderstanding or mistake occurs in the record of this application, a revised declaration, entitled "Revised Declaration I Under C.F.R. §1.132," is submitted concurrently herewith incorporating the omitted description. Notably, at page 7, the words "*the water, amine catalyst, and surfactant*" are added after the words "All of the polyol components". A sentence is entered into page 7, after the term "1800 rpm" on line 9, as follows: "A stoichiometric amount of toluene diisocyanate (Voramate T-80) was then added to the cup and vigorously mixed for 3 seconds at 2400 rpm."

The correction of the first Declaration does not change in any manner the comparative data or the conclusions drawn in the Declaration filed November 26, 2007. All

arguments, conclusions, and remarks made in that Declaration and its revised version submitted herewith remain in full effect.

The undersigned notes that a second Declaration, submitted concurrently herewith, provides additional evidence supportive of this application and clarifies the Affiant's position with respect to the disclosures in newly cited International Patent Application PCT/US2007/86222. Applicant considered combining the additional evidence into Revised Declaration I; however, for simplicity of organization, it was decided to submit the additional evidence in a second Declaration.

E. Concerning the Rejection of Claims 18-24 Under 35 USC 103(a)

Claims 18-24 stand rejected on a new ground for rejection, as allegedly being unpatentable over Frankel (U.S. 3,787,459), Abatjoglou, et al. (U.S. 4,731,486), and Bahrmann, et al. (CA 2,162,083). This rejection, as it may apply to all of Claims 18 to 34 and new Claim 25, is traversed for the following reasons.

All references herein to a "diol/triol" ratio or a "diformyl/triformyl" ratio are made with respect to weight ratios.

The Office Action cites Frankel as teaching "a process for hydroformylation of monounsaturated fatty acid/esters compounds from safflower oil into aldehyde using a highly selective hydroformylation catalyst system that uses rhodium." The Office Action is correct that Frankel relates to hydroformylated products, i.e., aldehydes. In fact, Frankel is primarily focused on monoformyl or diformyl products produced in high selectivity of greater than 85 or 75 percent, respectively. This result is removed from the present claims in two significant aspects.

(1) The claims relate to an alcohol composition having a claimed diol/triol ratio greater than 5/1. Frankel does not delineate any diformyl/triformyl ratio, let alone a diol/triol ratio.

(2) Applicants select the particularly claimed alcohol composition derived from seed oils to prepare polyurethanes having properties suitable for flexible foam applications. Frankel mentions a list of applications for a variety of formyl-substituted and derivatized products, but nowhere mentions flexible polyurethanes or the requirements therefor.

(3) The claimed alcohol having a diol/triol ratio greater than 5/1, illustrated in Applicants' Declaration under Rule 132 filed November 26, 2007 (hereinafter "first Declaration") and in Applicants' Declaration II under Rule 132 filed concurrently herewith (hereinafter "second Declaration"), possess advantageous properties, as compared with a comparative alcohol composition having a diol/triol ratio less than 5/1. Nowhere does Frankel lead the skilled person to any advantageous properties of downstream products resulting from an upstream alcohol composition.

Since Frankel only addresses mono- and di-aldehyde products, the skilled person cannot arrive at the claims starting from Frankel. Logic alone does not lead the skilled person from aldehydes to specific alcohols and then further downstream to flexible polyurethane foams.

Abatjoglou, et al. discloses hydroformylating low molecular weight terminal olefins (α -olefins), such as propylene and 1-butene, and somewhat higher molecular weight terminal

olefins, such as 1-decene and 1-dodecene (C_{12}). Generally, the reactant olefin comprises a single compound obtained from petroleum-based feedstocks. In contrast, the claimed composition is prepared by hydroformylating a mixture of mono-, di-, and tri-unsaturated fatty acid/esters that are almost always internal, not terminal, olefins having extended carbon chains (C_{6-50}) and obtained from non-petroleum (seed oil) feedstocks. (Claim 26)

The Office Action references Abatjoglou, et al. for stating “that varying ...*(process conditions)* ...allows targeted yield of the whichever particular aldehyde production ratio is desired.” This statement insinuates a closer relationship between the reference and the claimed invention than actually exists. In actuality, Abatjoglou, et al. discloses various process conditions influencing the normal to branched isomer distribution (N/I) of the product aldehydes. Terminal olefins can be hydroformylated at the α (terminal) carbon atom to give a normal product (N) or β (next to terminal) carbon atom to give branched products (I). The disclosed N/I ratio, however, is irrelevant to the present claims. Rather, the claims require a specific diol/triol weight ratio of greater than 5/1, which ratio relates not to isomers, but to mixtures of di-hydroxymethylated and tri-hydroxymethylated products, none of which is disclosed by Abatjoglou, et al.

Moreover, Abatjoglou, et al. discloses yield conversion of a single olefinic reactant having a single unsaturated bond; and the conversion is taken on all unsaturated bonds. In contrast, the claims relate to hydroformylating a complex mixture of mono-, di-, and tri-unsaturated compounds (unsaturated fatty acid/esters) to a conversion of greater than 80 but less than 99 percent of the first (or one) unsaturated bond per molecule (Claim 26) and with subsequent reduction to form the claimed alcohol product. We emphasize that conversion of 80 to 90 percent of the first (or one) unsaturated bond per molecule is not equivalent to converting 80 to 90 percent of the total unsaturated bonds in the mixture of mono-, di-, and tri-unsaturated fatty acid/esters. More to the point, Applicants’ method links the appropriate conversion of the fatty acid/ester mixture to advantageous properties of downstream flexible foam products. (*Vide infra.*)

Nowhere are the concepts of hydroformylating mixtures of extended-chain olefins using Applicants’ particular conversion measurement hinted at, let alone disclosed or suggested in Abatjoglou, et al. Nor can one find suggestions of subsequent hydrogenation to form alcohols that have beneficial effects for downstream polyurethane products. Clearly, logic cannot fill in the essential missing information to arrive at the claimed invention.

(Although Hanes (US 4,633,021) is not specifically mentioned in the latest Office Action, it has not either been explicitly withdrawn. The Applicant discounts Hanes as having no significant effect, because it had been relied upon for its teaching of an extraction procedure, not a feature more material to the invention.)

The Office Action cites Bahrmann, et al. as disclosing hydroformylating seed oils to formyl-substituted products with subsequent hydrogenation to hydroxymethyl-substituted products. We can agree that Bahrmann, et al. discloses hydroformylation and hydrogenation of a seed oil, but hydrogenation to form the alcohol product is not illustrated in any working example. Moreover, the resulting hydroxymethyl-substituted product (alcohol) is not characterized in any way whatsoever. In effect, the Office Action compares specific aldehyde compositions of Bahrmann, et al. to the claimed alcohol composition – a comparison between two different classes of chemical compounds (aldehydes versus alcohols). A rejection of an alcohol composition cannot be based on a comparison with an aldehyde composition.

The Office cites Bahrmann, et al. as disclosing hydroformylating a seed oil to a product comprising 26 percent monoformyl, 30 percent diformyl, and 47 triformyl products, by weight, for what Applicants calculate is a diformyl/triformyl ratio of only 0.64/1, well below the claimed diol/triol ratio of greater than 5/1. Applicants note that Example 6 of Bahrmann, et al. is closer to the claimed range for disclosing diformyl and triformyl yields of 17 and 5 percent, respectively, for a calculated diformyl/triformyl ratio of 3.4/1. Applicants have already shown in their first Declaration that a diol/triol ratio of 3.11/1 does not produce acceptable flexible foams. Nevertheless, the Office Action finds Applicants' first Declaration as allegedly inadequate for providing embodiments of the invention at only one diol/triol ratio of 14.07/1. The Office Action questioned if the same advantageous effects would also occur if the alcohol composition were to have a diol/triol ratio closer to the claimed minimum of 5/1.

Applicants provide herewith "Declaration II Under 37 C.F.R. §1.132" (second Declaration) describing preparation of a monomer alcohol having a diol/triol ratio of 5.56/1, which lies within the scope of the claims but closer to the minimum of 5/1. The new examples involve hydroformylating sunflower oil comprising a mixture of unsaturated fatty acid methyl esters, and then hydrogenating the resulting mixture of formyl-substituted fatty acid methyl esters to form an embodiment of the claimed alcohol composition comprising a mixture of mono-, di-, and tri-hydroxymethyl substituted fatty esters having a diol/triol ratio of 5.56/1. The second Declaration clearly shows that, even at a ratio close to the minimum of 5/1, polyurethane foams prepared from the claimed monomer alcohol provide acceptable properties for flexible foam applications. No tin splits or other defects were observed. When the data from the second Declaration are compared with the comparative experiments set forth in the first Declaration, particularly CE-5 as the closest comparison (diol/triol = 3.11/1), the comparison again proves the advantages of the claimed composition.

The Office Action refers to the combination of Frankel, Abatjoglou, et al, and Bahrmann, et al, as providing a "reasonable expectation of success" in preparing the claimed alcohol composition because "the prior art suggests that a corresponding alcohol may be successfully produced from the aldehyde produced by hydroformylation." Applicants respectfully disagree. What the Applicants are targeting for success is selection of an alcohol composition derived from seed oils that provides an acceptable downstream polyurethane flexible foam; and from their own research they found that not all alcohol compositions produced from hydroformylation/reduction of seed oils produce successful downstream flexible foams. The prior art is devoid of the concepts and linkages that form a crucial basis for the claims. Applicants' comparative data provide the necessary secondary evidence commensurate in scope with the claims to render the claims non-obvious.

In an effort to meet fully the obligations of disclosure, the undersigned and Applicants have cited herein International Patent Application PCT/US07/86222, currently unpublished, filed on December 3, 2007 naming some inventors in common with the present application. The PCT application claims an alcohol composition having a diol/triol weight ratio less than 5/1 for preparing acceptable flexible foams. Significantly, a new parameter called the "average functionality number (AFN)" must be taken into account in order to make good foams when starting with an alcohol of ratio less than 5/1. The prior art does not recognize, calculate, or discuss the importance of AFN or its effect upon a downstream polyurethane composition. Thus, several members of the instant inventive entity, themselves, subsequently discovered how to make good flexible foams at a diol/triol weight ratio less than 5/1, which discovery became the subject of PCT/US07/86222.

With respect to the current application, the Applicants believe that the comparative data (CE-1 to CE-5) provided in the first Declaration at a diol/triol weight ratio less than 5/1, which fail at making flexible foams, are a fair representation of the prior art at the time the present invention was made, and that any advancement towards making successful flexible foams at a diol/triol weight ratio less than 5/1 requires an additional inventive step, which forms the subject of cited PCT application originating in Applicants' employer's laboratory.

In view of the above, it is asserted that the claimed alcohol composition is not logically deduced, i.e., not *prima facie* obvious, over Bahrmann, et al., alone or in combination with Frenkel and/or Abatjoglou, et al. Accordingly, all of the claims meet the statutory requirements of 35 U.S.C. 103(a). It is respectfully requested that the rejection be withdrawn.

F. Conclusions

Applicants have responded to the objection and rejection of the claims as set forth in the Office Action of January 31, 2008. An amendment to the specification has been made; a new claim is added; and a second Declaration has been provided supplementing the first Declaration by presenting additional evidence of the advantages of the claimed composition. In view of the above, it is submitted that Claims 18 to 34 and new Claim 35 meet the standards for patentability. A Notice of Allowance is respectfully requested at the Examiner's earliest convenience.

Respectfully submitted,

/Marie F. Zuckerman/
Marie F. Zuckerman
Registration No. 31,315
Agent for Lysenko, et al.
Phone: 203-248-3907

Date : April 25, 2008

P. O. Box 1967
Midland, MI 48641-1967

Enc.

Supplementary Information Disclosure Statement
Form PTO SB/08/a
Copy of International Patent Appln. PCT/US2007/86222
Copy of Publication *Catalysis of Organic Reactions*
Revised Declaration I Under 37 C.F.R. §1.132
Declaration II Under 37 C.F.R. §1.132

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